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STABILIZATION OF SHIPS BY MEANS OF LIQUID FILLED TANKS

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Fig. 1

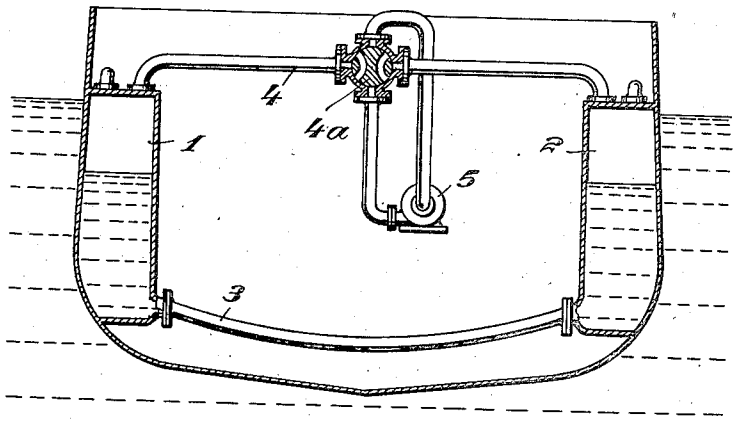
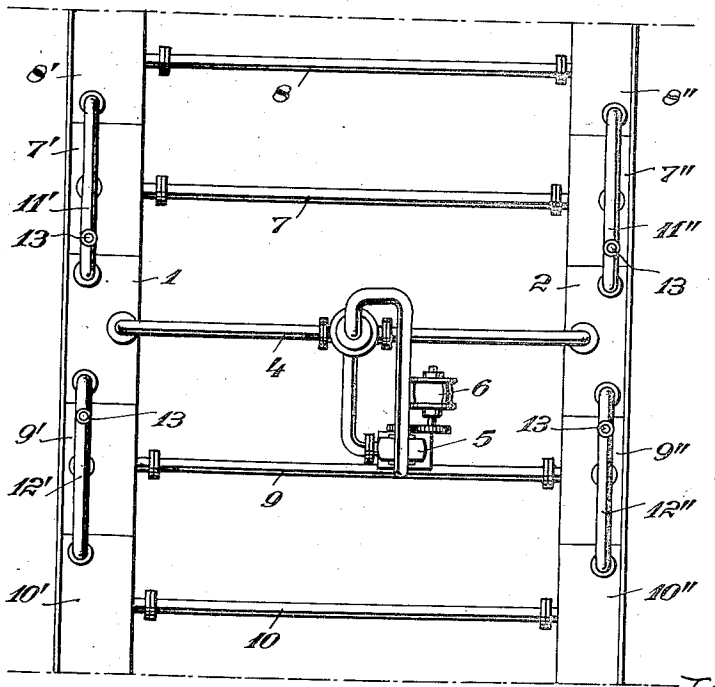


Fig. 2



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STABILIZATION OF SHIPS BY MEANS OF LIQUID FILLED TANKS

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4 Claims. (Cl. 114—125)

This invention relates to the stabilization of ships by means of liquid filled tanks, arranged along the sides of the ship.

According to one feature of the invention a first pair of transversely opposed main tanks is provided in combination with a delivering device, i. e. a blower, for propelling the liquid masses of these tanks in accordance with the roll of the ship so as to damp the rolling motion. In a well known manner the delivering device may also be used for propelling the liquid masses of the tanks more and more to one side of the ship when the ship assumes a constantly inclined position due to wind, unsymmetrical cargo or the like, in order to compensate this inclination of the ship.

However as the liquid masses of the normal tank stabilizing devices are very small in relation to the whole capacity of the ship, these masses are sufficient for damping the periodic rolling motion of the ship but not sufficient for compensating the aforesaid inclined middle position due to wind or the like. Although the delivering device, propelling the damping masses periodically in accordance with the rolling from one side to the other, is large enough to drive gradually large masses sufficient for compensating a constant inclination of the ship into the tank of the upwards inclined side, nevertheless such compensation is still impossible as the damping masses are too small.

In order to obviate this disadvantage according to a further feature of the invention the damping masses may be augmented at will by further liquid masses such as oil, serving as fuel for the power engines of the ship, and usually being contained in tanks near the sides of the ship. According to this invention those or similar tanks, which for convenience may be termed auxiliary tanks, are arranged on each side of the ship near the aforesaid main tanks, serving for damping the periodic rolling of the ship and controlled by a blower or other pump. The liquid spaces of the oppositely positioned auxiliary tanks are also interconnected by conducting pipes, the air spaces of the tanks, arranged along the same side of the ship being also interconnected by pipes to the air space of the main tank on the corresponding side of the ship. These latter air pipes are of relatively small diameter and preferably are provided with valves for shutting off these pipes in order to make sure that the blower or other pump, interconnected to the pair of main tanks will have no effect on the liquid in the auxiliary tanks as long as the direction of propelling is always altered in sympathy with the rolling of the ship but will also propel the liquid masses of these auxiliary tanks, as soon as the pump acts to constantly drive the liquid masses to the upwards inclined side of the ship in order to compensate a constant inclination of the ship.

The invention will be better understood from the following description taken in connection with the accompanying drawing in which

Figure 1 is a cross sectional view of the vessel with the two tanks connected directly to the delivering device;

Figure 2 is a plan view upon the middle part of the ship with the whole stabilizing system.

Near the middle of the ship there is provided a rolling tank-system of a well-known type, consisting of the two tanks 1 and 2 oppositely positioned on each side of the ship. These tanks may be water-filled, the liquid spaces being interconnected by the conducting pipe 3 and the air spaces by the conducting pipe 4. In this pipe 4 a two-way cock 4a is provided, actuated in accordance with the rolling of the ship and connecting the blower 5, driven by the constantly running motor 6, to the one or the other tank 1 or 2 as the case may be.

According to the invention, besides each tank 1 and 2 there are provided along the hull of the ship auxiliary tanks 7', 7'', 8', 8'', 9', 9'', 10' and 10''. These auxiliary tanks may be preferably filled with oil, serving as fuel for the power engines of the ship or for similar purposes. Each pair of oppositely positioned tanks 7', 7'' respectively 8', 8'', 9', 9'' or 10', 10'' are interconnected respectively by a liquid conducting pipe 7, 8, 9 or 10 of a relatively small diameter. The air spaces of these auxiliary tanks 7'—10' and 7''—10'' are connected to the air spaces of the water-filled tanks 1 and 2 by means of the air conducting pipes 11' and 12' or 11'' and 12'' respectively.

As long as the rolling motion of the ship is to be damped by the arrangement described, the two-way cock is switched over by hand or automatically in sympathy with the rolling motion. In consequence of this the blower 5 will propel a certain quantity of air from the tank at the one side of the ship into the oppositely positioned tank at the other side of the ship and return, this propelling taking place during each oscillation period of the ship. However, as the oscillation periods of the ship are relatively small, for example 20 seconds, and as the air conducting pipes 11', 11'', 12' and 12'' as well as the liquid conducting pipes 7—10 are very strongly throttled, practically only the water masses of the tanks 1 and 2 will partici-

pate in the described mutual propelling movement. In order to entirely prevent movement of the liquid in the auxiliary tank devices 7—10 totally, during this periodical damping the rolling of the ship, the conducting pipes 11', 11'', 12' and 12'' may be closed by the valves 13 arranged in these pipes and operated for instance by hand.

However, as soon as the device described is to be used for compensating a constantly inclined position of the ship due to wind, unbalanced cargo or the like, the two-way cock 4a is switched over into the position, in which the blower 5 propels the air out of the tanks of the upwards inclined side into the tanks of the downwards inclined side of the ship. The switching over of the cock 4a may be effected by hand or electromagnetically according to the deflection of a device measuring the middle inclination of the ship about its longitudinal axis. In contradistinction to the above described damping of rolling, the propelling of air in one and the same direction, when the ship assumes a constantly inclined position, will continue for a longer time interval, i. e. for several minutes until the inclined position of the ship is compensated partly or wholly. In such case, the valves 13 being opened, the air of the auxiliary tanks 7', 8', 9', 10' and 7'', 8'', 9'', 10'' will pass through the narrow pipes 11', 11'', 12' and 12'' respectively into the main tanks 1 and 2 so as to participate in the compensating of the inclined position of the ship. It will be understood that the air delivered from the tanks of the upwardly inclined side into the oppositely positioned tanks of the downwardly inclined side causes the water or the oil of the tanks to flow through the pipes 3, 7, 8, 9 and 10 into the tanks of the upwardly inclined side. The opening of the above mentioned valves 13 at the beginning of compensating a constantly inclined position of the ship may also be effected automatically, for example by an electromagnet, actuated by a well-known device measuring the middle inclined position of the ship about its longitudinal axis.

It will be evident, that all the tanks may be water-filled and may have apertures opening downward to the sea, in which case the liquid conducting pipes, designated in the drawing with 3, 7, 8, 9 and 10, will be omitted. With such an arrangement the sea water will pass in and out of the tanks through said apertures according to the quantities of air, delivered from one side of the ship to the other by the blower 5.

I claim as my invention:

1. In a tank stabilizing apparatus for ships, the combination of a plurality of tanks adapted to contain liquid and located on one side of a ship, conduits connecting the air spaces of said tanks, additional tanks adapted to contain liquid and located on the other side of said ship, conduits connecting the air spaces of said additional tanks, conduits extending transversely of said ship and connecting the liquid containing spaces of each pair of oppositely located tanks, an air conduit extending transversely of the ship and connecting the air spaces of a pair of oppositely located tanks, a propelling device connected with said transverse air conduit, and means for controlling said propelling device.

2. In a tank stabilizing apparatus for ships, the combination of a plurality of tanks adapted to contain liquid and located on one side of a ship, conduits connecting the air spaces of said tanks, said air conduits having comparatively small diameters for the purpose of throttling the flow of air therethrough, additional tanks adapted to contain liquid and located on the opposite side of said ship, conduits connecting the air spaces of said additional tanks, said last named air conduits having comparatively small diameters for the purpose of throttling the flow of air therethrough, conduits extending transversely of the ship and connecting the liquid containing spaces of each pair of oppositely located tanks, an air conduit extending transversely of the ship and connecting the air spaces of a pair of oppositely located tanks, a propelling device connected with said transverse air conduit, and means for controlling said propelling device.

3. In a tank stabilizing apparatus for ships, the combination of a plurality of tanks adapted to contain liquid and located on one side of a ship, conduits connecting the air spaces of said tanks, additional tanks adapted to contain liquid and located on the other side of said ship, conduits connecting the air spaces of said additional tanks, conduits extending transversely of said ship and connecting the liquid containing spaces of each pair of oppositely located tanks, an air conduit extending transversely of the ship and connecting the air spaces of a pair of oppositely located tanks, a propelling device connected with said transverse air conduit, means for controlling said propelling device, and control valves in the conduits connecting the air spaces of the tanks on one side of the ship, and in the conduits connecting the air spaces of the tanks on the other side of said ship.

4. A tank stabilizing device for ships, comprising a first pair of liquid filled tanks oppositely positioned along the two sides of the ship, a circulation conduit connected with said tanks, a constantly running propelling device connected with said conduit by means of a two-way-cock, means for controlling said two-way cock in accordance with the inclination of the ship, additional pairs of oppositely positioned tanks adapted to contain oil and arranged along the opposite sides of the ship, transverse conduits connecting the liquid spaces of each of these additional pairs of tanks and air conduits connecting the air spaces of said additional tanks with the air spaces of said first pair of tanks in such a way that the air spaces of the tanks arranged along the same side of the ship communicate with each other.

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